



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES, AND
TOXIC SUBSTANCES

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MEMORANDUM

SUBJECT: Additional Estimated Environmental Concentrations for Thiophanate-methyl (PC Code:102001) and Its Major Degradate, MBC (PC Code:128872), for Application on Turf and Onions

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Summary

This additional assessment was prepared by EFED in response to the request of Ms. Deanna Scher of SRRD (4/3/01 email) who was interested in knowing the Estimated Environmental Concentrations (EECs) for thiophanate-methyl and its major degradate, MBC (methyl 2-benzimidazolylcarbamate or carbendazim) if the next highest application rates as proposed for turf and onions were used in the environmental fate and transport modeling. The current memo should not be viewed nor be interpreted as a typical Tier I or Tier II assessment of EFED. For turf for which 15 lb a.i./A of thiophanate-methyl is applied 6 times per season, SRRD requested that the models, GENECC and SCIGROW, be used for calculating EECs in surface water and groundwater, respectively. The model results are summarized in Table 1:

Table 1. EECs resulting from application on turf.

Chemical	<u>GENEEC: Surface Water (ug/L)</u>		<u>SCIGROW: Groundwater (ug/L)</u>
	Acute	Chronic	
Thiophanate-methyl (parent)	421	221	0.033
MBC (degrade)	324	147	3.03

For onions for which 15 lb a.i./A of thiophanate-methyl is applied once per season, SRRD requested that the models PRZM/EXAMS and SCIGROW be used for calculating EECs in surface water and groundwater, respectively. The model results are summarized in Table 2.

Table 2. EECs resulting from application on onions.

Chemical	<u>PRZM/EXAMS: Surface Water (ug/L)</u>				<u>SCIGROW: Groundwater (ug/L)</u>
	Peak	60-day	1 in 10 yr. value	36-yr. annual mean value	
Thiophanate-methyl (parent)	50.4	2.33	0.441	0.440	0.006
MBC (degrade)	208	131	89.0	73.5	0.51

1.0 ESTIMATION OF SURFACE WATER AND GROUNDWATER EXPOSURE CONCENTRATIONS

The input parameter for the maximum application rate associated with MBC was calculated from the thiophanate-methyl's application rate (15 lbs. a.i./A), stoichiometric conversion factor of thiophanate-methyl to MBC (mass conversion ratio or molecular weight ratio of MBC to thiophanate-methyl = 0.56), and conversion efficiency fraction (0.827) from soil aerobic metabolism (a dominant dissipation route). Using these values, the application rate for MBC was calculated to be (15)(0.56)(0.827) or 6.95 lb a.i./A. For turf, the estimated application rate for MBC (6.95 lb a.i./A) and the given application rate of thiophanate-methyl (15 lb a.i./A) were used in the two screening models GENECC and SCIGROW for EECs in surface water and groundwater, respectively. For onions, similar application rates for MBC and thiophanate-methyl were used in PRZM/EXAMS for EECs in surface water and SCIGROW for EECs in groundwater.

2.0 Background Information on GENECC:

GENECC is a screening model designed to estimate the pesticide concentrations found in water for use in ecological risk assessments. As such, it provides high-end values on the concentrations

that might be found in ecologically sensitive environments due to the use of pesticide. GENEEC is a single-event model (one run-off event), but can account for spray drift from multiple applications. GENEEC is hardwired to represent a 10-ha field immediately adjacent to a 1-ha pond, 2 meters deep, with no outlet. The pond receives a spray drift event from each application plus one runoff event. The runoff event moves a maximum of 10% of the applied pesticide into the pond. This amount can be reduced due to degradation on field and the effect of binding to soil. Spray drift is equal to 1% of the applied concentration from the ground spray application and 5% for aerial applications.

Though GENEEC was not originally designed for use in drinking water risk assessments, it does provide a reasonable upper-bound estimate for screening purposes. Surface-water source drinking water tends to come from bodies of water that are substantially larger than a 1-ha pond. Furthermore, GENEEC assumes that essentially the entire basin receives an application of the chemical. In virtually all cases, basins large enough to support a drinking water utility will contain a substantial fraction of area that does not receive the chemical. Additionally, there is always some flow (in a river) or turnover (in a lake or reservoir) of the water so that the persistence of the chemicals near the drinking water utility intakes will be overestimated. Given all these factors, GENEEC does provide an upper-bound estimate of the concentration of a pesticide that could be found at the drinking water utility and therefore can be appropriately used in screening calculations. If a risk assessment performed using GENEEC output does not exceed the level of concern, then one can be reasonably confident that the actual risk will not be exceeded. However, because GENEEC can substantially overestimate true drinking water concentrations, it will be necessary to refine the GENEEC estimates if the level of concern is exceeded.

3.0 Background Information on SCIGROW:

SCIGROW provides a groundwater screening exposure value to be used in determining the potential risk to human health from drinking water contaminated with the pesticide. Since the SCIGROW concentrations are likely to be approached in only a very small percentage of drinking water sources, i.e., highly vulnerable aquifers, it is not appropriate to use SCIGROW for national or regional exposure estimates.

SCIGROW estimates likely groundwater concentrations if the pesticide is used at the maximum allowable rate in areas where groundwater is exceptionally vulnerable to contamination. In most cases, a large majority of the use area will have groundwater that is less vulnerable to contamination than the areas used to derive the SCIGROW estimate.

4.0 Background Information on PRZM/EXAMS

The linked PRZM and EXAMS is typically used by EFED to estimate concentrations of pesticides in surface waters. PRZM is the component designed to cover phenomena such as temperature simulation, volatilization, vapor transport and microbial transformation in the surficial layer and root zone subhorizons. It is employed to evaluate surface runoff loading to a receiving surface water bodies such as lakes, farm ponds, streams, and index reservoirs. As soon as the pesticide

residues reaches a surface water, EXAMS uses its algorithms to calculate the pesticides concentrations by taking into account different dissipation mechanisms in the aqueous and sediment phases, weather patterns, and periodic application of pesticides for several years. EXAMS is fairly and relatively complex model that requires more input variable, ranging from hydrogeological data to pesticide physicochemical properties, mobility coefficients, and degradation rate constants in the aqueous and sediment phases. It also contains algorithms for representing spatial details and chemical degradation pathways.

5.0 Modeling Inputs and Results:

Tables 1 and 2 summarize the input values used in the model runs for GENEEC, PRZM/EXAMS, and SCIGROW, respectively. The application information used in turf and onions are shown in Table 3. The modeling results are presented in Table 4 and Table 5.. Attached to this memo are copies of the printouts generated from the GENEEC, PRZM/EXAMS, and SCIGROW runs.

Table 1. Important Environmental Fate Input Parameters for Thiophanate-methyl and MBC in GENEEC and PRZM/EXAMS.

Parameter	Thiophante-methyl (TM)	MBC	Source Thiophanate-methyl / MBC
PC Code	102001	128872	EFED Files
Water Solubility (ppm)	21.8	8	Product Chemistry
Hydrolysis Half-Life (pH 7) (days)	36	0 (stable)	MRID 40095507/Acc.# 00151418
Aerobic Soil Metabolism Half-Life (days)	1	320	MRID 106085/MRID 41255801
Aerobic Aquatic Metabolism Half-life (days)	0 (stable)	61	MRID 40061501/MRID 41137701
Photolysis Half-Life at pH 7 (days)	2.48	0 (stable)	MRID 41482806/Acc.# 00151419
Organic Carbon Adsorption Coefficient (K _{OC})	314 (Avg.)	1885(Avg.)	MRID 42351001/Acc.# 00151422

Table 2. Environmental Fate Input Parameters for Thiophanate-methyl and MBC in SCIGROW.

Parameter	Thiophanate-methyl (TM)	MBC	Source Thiophanate-methyl / MBC
Organic Carbon Partition Coefficient (K_{OC})	314 (Avg.)	1885 (Avg.)	MRID 42351001/ Acc.# 00151422
Aerobic Soil Metabolism Half-Life (days)	1	320	MRID 106085 / MRID 41255801

Table 3. Application information for **Thiophanate-methyl** and **MBC** on turf and onions.

Parameter	Thiophanate-methyl		MBC		Source
	Turf	Onions	Turf	Onions	
Application Method	Ground	Ground	Ground	Ground	Product Label
Application Rate (lb ai/A)	15	15	6.95	6.95	Product Label
Application Frequency	6	1	6	1	Product Label
Application Interval (days)	10	0	10	0	Product Label

Table 4. Modeling Results for Turf

Parameter	Thiophanate-methyl	MBC
GENEEC Peak EEC (ug/L)	421	324
GENEEC 56-Day EEC (ug/L)	221	147
SCIGROW Groundwater Concentration (ug/L)	0.033	3.03

Table 5. Modeling Results for Onions.

Parameter	Thiophanate-methyl	MBC
PRZM/EXAMS Peak EEC (ug/L)	50. 4	208
PRZM/EXAMS 60-Day EEC (ug/L)	2.33	131
PRZM/EXAMS 1 in 10 yr. EEC (ug/L)	0.441	89.0
PRZM/EXAMS 36-yr.annual mean EEC (ug/L)	0.440	73.5
SCIGROW Groundwater Concentration (ug/L)	0.006	0.51

ATTACHMENT A: GENEEC and SCIGROW Modeling Results for Turf

GENEEC Run for TM on Turf

RUN No. 1 FOR TM INPUT VALUES

RATE (#/AC ONE(MULT))	APPLICATIONS NO.-INTERVAL	SOIL KOC	SOLUBILITY (PPM)	% SPRAY DRIFT	INCORP DEPTH(IN)
15.000(15.015)	6	10	314.0	21.8	1.0 .0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC COMBINED	DAYS UNTIL HYDROLYSIS	PHOTOLYSIS	METABOLIC
(FIELD) RAIN/RUNOFF	(POND)	(POND-EFF)	(POND)

1.00	0	36.00	2.48-	304.30	.00	32.19
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GENERIC EECs (IN PPB)

PEAK GEEC	AVERAGE 4 DAY GEEC	AVERAGE 21 DAY GEEC	AVERAGE 56 DAY GEEC
421.09	404.66	325.14	221.82

GENEEC Run for MBC (from TM) on Turf

RUN No. 1 FOR MBC

INPUT VALUES

RATE (#/AC ONE(MULT)	APPLICATIONS NO.-INTERVAL	SOIL KOC	SOLUBILITY (PPM)	% SPRAY DRIFT	INCORP DEPTH(IN)
6.950(39.529)	6	10	1885.0	8.0	1.0 .0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC COMBINED	DAYS UNTIL HYDROLYSIS	PHOTOLYSIS	METABOLIC		
(FIELD)	RAIN/RUNOFF	(POND)	(POND-EFF)	(POND)	(POND)

320.00	0	N/A	.00-	.00	61.00	61.00
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GENERIC EECs (IN PPB)

PEAK GEEC	AVERAGE 4 DAY GEEC	AVERAGE 21 DAY GEEC	AVERAGE 56 DAY GEEC
323.68	304.59	224.98	147.08

SCIGROW Run for TM on Turf

RUN No. 1 FOR TM

INPUT VALUES

APPL (#/AC)	APPL. URATE	SOIL NO.	SOIL KOC	AEROBIC METABOLISM (DAYS)
RATE	(#/AC/YR)			

15.000	6	90.000	314.0	1.0
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GROUND-WATER SCREENING CONCENTRATIONS IN PPB

.033478

A= .167 B= 319.000 C= -.778 D= 2.504 RILP= -1.948
F= -3.429 G= .000 URATE= 90.000 GWSC= .033478

SCIGROW Run for MBC (from TM) on Turf

RUN No. 1 FOR MBC

INPUT VALUES

APPL (#/AC)	APPL. URATE	SOIL NO.	SOIL KOC	AEROBIC METABOLISM (DAYS)
RATE	(#/AC/YR)			

6.950	6	41.700	1885.0	320.0
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GROUND-WATER SCREENING CONCENTRATIONS IN PPB

3.032398

A= 315.000 B= 1890.000 C= 2.498 D= 3.276 RILP= 1.808
F= -1.138 G= .073 URATE= 41.700 GWSC= 3.032398

**ATTACHMENT B: PRZM/EXAMS and SCIGROW Modeling Results for
Onions**

PRZM/EXAMS run for TM on CA onions

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1948	50.380	26.640	6.652	2.330	1.553	0.440
1949	50.380	26.640	6.652	2.330	1.553	0.441
1950	50.380	26.640	6.652	2.330	1.553	0.441
1951	50.380	26.640	6.652	2.330	1.553	0.441
1952	50.380	26.640	6.652	2.330	1.553	0.440
1953	50.380	26.640	6.652	2.330	1.553	0.441
1954	50.380	26.640	6.652	2.330	1.553	0.441
1955	50.380	26.640	6.652	2.330	1.553	0.441
1956	50.380	26.640	6.652	2.330	1.553	0.440
1957	50.380	26.640	6.652	2.330	1.553	0.440
1958	50.380	26.640	6.648	2.328	1.552	0.441
1959	50.380	26.640	6.652	2.330	1.553	0.441
1960	50.380	26.640	6.652	2.330	1.553	0.439
1961	50.380	26.640	6.652	2.330	1.553	0.441
1962	50.380	26.640	6.652	2.330	1.553	0.440
1963	50.380	26.640	6.652	2.330	1.553	0.440
1964	50.380	26.640	6.652	2.330	1.553	0.440
1965	50.380	26.640	6.652	2.330	1.553	0.441
1966	50.380	26.640	6.652	2.330	1.553	0.441
1967	50.380	26.640	6.652	2.330	1.553	0.441
1968	50.380	26.640	6.652	2.330	1.553	0.439
1969	50.380	26.640	6.652	2.330	1.553	0.441
1970	50.380	26.640	6.652	2.330	1.553	0.441
1971	50.380	26.640	6.652	2.330	1.553	0.441
1972	50.380	26.640	6.652	2.330	1.553	0.440
1973	50.380	26.640	6.652	2.330	1.553	0.441
1974	50.380	26.640	6.652	2.330	1.553	0.440
1975	50.380	26.640	6.652	2.330	1.553	0.441
1976	50.380	26.640	6.639	2.325	1.550	0.439
1977	50.380	26.640	6.652	2.330	1.553	0.441
1978	50.380	26.640	6.652	2.330	1.553	0.441
1979	50.380	26.640	6.652	2.330	1.553	0.441
1980	50.380	26.640	6.652	2.330	1.553	0.440

1981	50.380	26.640	6.652	2.330	1.553	0.441
1982	50.380	26.640	6.652	2.330	1.553	0.441
1983	50.380	26.640	6.652	2.330	1.553	0.441

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	50.380	26.640	6.652	2.330	1.553	0.441
0.054	50.380	26.640	6.652	2.330	1.553	0.441
0.081	50.380	26.640	6.652	2.330	1.553	0.441
0.108	50.380	26.640	6.652	2.330	1.553	0.441
0.135	50.380	26.640	6.652	2.330	1.553	0.441
0.162	50.380	26.640	6.652	2.330	1.553	0.441
0.189	50.380	26.640	6.652	2.330	1.553	0.441
0.216	50.380	26.640	6.652	2.330	1.553	0.441
0.243	50.380	26.640	6.652	2.330	1.553	0.441
0.270	50.380	26.640	6.652	2.330	1.553	0.441
0.297	50.380	26.640	6.652	2.330	1.553	0.441
0.324	50.380	26.640	6.652	2.330	1.553	0.441
0.351	50.380	26.640	6.652	2.330	1.553	0.441
0.378	50.380	26.640	6.652	2.330	1.553	0.441
0.405	50.380	26.640	6.652	2.330	1.553	0.441
0.432	50.380	26.640	6.652	2.330	1.553	0.441
0.459	50.380	26.640	6.652	2.330	1.553	0.441
0.486	50.380	26.640	6.652	2.330	1.553	0.441
0.514	50.380	26.640	6.652	2.330	1.553	0.441
0.541	50.380	26.640	6.652	2.330	1.553	0.441
0.568	50.380	26.640	6.652	2.330	1.553	0.441
0.595	50.380	26.640	6.652	2.330	1.553	0.441
0.622	50.380	26.640	6.652	2.330	1.553	0.441
0.649	50.380	26.640	6.652	2.330	1.553	0.440
0.676	50.380	26.640	6.652	2.330	1.553	0.440
0.703	50.380	26.640	6.652	2.330	1.553	0.440
0.730	50.380	26.640	6.652	2.330	1.553	0.440
0.757	50.380	26.640	6.652	2.330	1.553	0.440
0.784	50.380	26.640	6.652	2.330	1.553	0.440
0.811	50.380	26.640	6.652	2.330	1.553	0.440
0.838	50.380	26.640	6.652	2.330	1.553	0.440
0.865	50.380	26.640	6.652	2.330	1.553	0.440
0.892	50.380	26.640	6.652	2.330	1.553	0.440
0.919	50.380	26.640	6.652	2.330	1.553	0.439

0.946	50.380	26.640	6.648	2.328	1.552	0.439
0.973	50.380	26.640	6.639	2.325	1.550	0.439
1/10	50.380	26.640	6.652	2.330	1.553	0.441

MEAN OF ANNUAL VALUES = 0.440

STANDARD DEVIATION OF ANNUAL VALUES = 0.001

UPPER 90% CONFIDENCE LIMIT ON MEAN = 0.441

PRZM/EXAMS run for MBC (from TM) on CA onions

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1948	89.050	81.330	58.870	38.300	32.230	9.340
1949	130.000	122.000	98.760	77.760	71.370	62.050
1950	132.000	124.000	100.000	79.260	72.890	66.120
1951	136.000	128.000	105.000	85.020	79.340	70.890
1952	206.000	196.000	163.000	128.000	115.000	84.280
1953	189.000	180.000	152.000	121.000	110.000	86.940
1954	138.000	130.000	107.000	87.240	82.060	75.240
1955	144.000	136.000	112.000	98.770	91.920	80.340
1956	143.000	135.000	112.000	93.700	88.540	79.960
1957	138.000	130.000	107.000	86.350	79.990	74.900
1958	128.000	120.000	97.400	82.910	77.880	66.160
1959	141.000	133.000	109.000	90.460	86.100	74.390
1960	161.000	154.000	132.000	108.000	99.330	87.290
1961	131.000	123.000	99.530	78.560	72.210	64.550
1962	128.000	120.000	96.410	76.760	71.140	63.120
1963	134.000	126.000	102.000	81.410	75.030	68.420
1964	136.000	128.000	105.000	83.490	77.050	70.040
1965	215.000	203.000	169.000	132.000	119.000	91.880
1966	214.000	204.000	171.000	136.000	124.000	95.990
1967	134.000	126.000	103.000	88.400	83.780	72.390
1968	131.000	123.000	99.350	84.370	77.680	67.080
1969	147.000	141.000	121.000	99.470	91.390	71.130
1970	137.000	129.000	106.000	84.770	79.000	71.980

1971	135.000	127.000	109.000	92.180	85.470	73.220
1972	214.000	203.000	168.000	131.000	118.000	102.000
1973	135.000	127.000	104.000	94.180	89.570	74.370
1974	137.000	129.000	107.000	90.130	83.540	74.590
1975	128.000	120.000	96.830	75.870	70.150	62.820
1976	131.000	123.000	109.000	93.390	85.430	72.000
1977	140.000	132.000	110.000	93.990	87.530	78.240
1978	200.000	190.000	160.000	133.000	122.000	87.700
1979	161.000	154.000	132.000	108.000	99.530	81.910
1980	135.000	127.000	103.000	86.680	81.430	71.840
1981	135.000	127.000	107.000	87.980	80.860	72.330
1982	137.000	129.000	111.000	93.260	86.520	75.320
1983	126.000	118.000	102.000	84.600	76.740	65.030

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
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0.027	215.000	204.000	171.000	136.000	124.000	102.000
0.054	214.000	203.000	169.000	133.000	122.000	95.990
0.081	214.000	203.000	168.000	132.000	119.000	91.880
0.108	206.000	196.000	163.000	131.000	118.000	87.700
0.135	200.000	190.000	160.000	128.000	115.000	87.290
0.162	189.000	180.000	152.000	121.000	110.000	86.940
0.189	161.000	154.000	132.000	108.000	99.530	84.280
0.216	161.000	154.000	132.000	108.000	99.330	81.910
0.243	147.000	141.000	121.000	99.470	91.920	80.340
0.270	144.000	136.000	112.000	98.770	91.390	79.960
0.297	143.000	135.000	112.000	94.180	89.570	78.240
0.324	141.000	133.000	111.000	93.990	88.540	75.320
0.351	140.000	132.000	110.000	93.700	87.530	75.240
0.378	138.000	130.000	109.000	93.390	86.520	74.900
0.405	138.000	130.000	109.000	93.260	86.100	74.590
0.432	137.000	129.000	109.000	92.180	85.470	74.390
0.459	137.000	129.000	107.000	90.460	85.430	74.370
0.486	137.000	129.000	107.000	90.130	83.780	73.220
0.514	136.000	128.000	107.000	88.400	83.540	72.390
0.541	136.000	128.000	107.000	87.980	82.060	72.330
0.568	135.000	127.000	106.000	87.240	81.430	72.000
0.595	135.000	127.000	105.000	86.680	80.860	71.980
0.622	135.000	127.000	105.000	86.350	79.990	71.840
0.649	135.000	127.000	104.000	85.020	79.340	71.130

0.676	134.000	126.000	103.000	84.770	79.000	70.890
0.703	134.000	126.000	103.000	84.600	77.880	70.040
0.730	132.000	124.000	102.000	84.370	77.680	68.420
0.757	131.000	123.000	102.000	83.490	77.050	67.080
0.784	131.000	123.000	100.000	82.910	76.740	66.160
0.811	131.000	123.000	99.530	81.410	75.030	66.120
0.838	130.000	122.000	99.350	79.260	72.890	65.030
0.865	128.000	120.000	98.760	78.560	72.210	64.550
0.892	128.000	120.000	97.400	77.760	71.370	63.120
0.919	128.000	120.000	96.830	76.760	71.140	62.820
0.946	126.000	118.000	96.410	75.870	70.150	62.050
0.973	89.050	81.330	58.870	38.300	32.230	9.340

1/10 208.400 198.100 164.500 131.300 118.300 88.954

MEAN OF ANNUAL VALUES = 73.496

STANDARD DEVIATION OF ANNUAL VALUES = 14.509

UPPER 90% CONFIDENCE LIMIT ON MEAN = 77.077

SCIGROW Run for TM on CA Onions

RUN No. 1 FOR TM

INPUT VALUES

APPL (#/AC) RATE	APPL. URATE NO. (#/AC/YR)	SOIL KOC	SOIL AEROBIC METABOLISM (DAYS)
15.000	1	15.000	314.0 1.0

GROUND-WATER SCREENING CONCENTRATIONS IN PPB

.005580

A= .167 B= 319.000 C= -.778 D= 2.504 RILP= -1.948
F= -3.429 G= .000 URATE= 15.000 GWSC= .005580

SCIGROW Run for MBC (from TM) on Onion

MBC (from TM) on CA Onions

RUN No. 2 FOR MBC

INPUT VALUES

APPL (#/AC)	APPL. URATE	SOIL NO.	SOIL KOC	AEROBIC METABOLISM (DAYS)
RATE	(#/AC/YR)			

6.950	1	6.950	1885.0	320.0
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GROUND-WATER SCREENING CONCENTRATIONS IN PPB

.505400

A= 315.000	B= 1890.000	C= 2.498	D= 3.276	RILP= 1.808
F= -1.138	G= .073	URATE= 6.950	GWSC= .505400	

